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Natori

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(54) **DISPLAY DEVICE, CONTROL METHOD OF DISPLAY DEVICE AND PROGRAM**

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G06F 3/0488 (2013.01)
G06F 3/0354 (2013.01)

(52) **U.S. Cl.**
CPC ***G06F 3/0308*** (2013.01); ***G06F 3/03545*** (2013.01); ***G06F 3/04883*** (2013.01)

(58) **Field of Classification Search**
CPC B43L 1/004; B43L 9/00; B43L 9/02; G03B 21/14; G06F 3/03; G06F 3/0304; G06F 3/0308; G06F 3/0325; G06F 3/03545; G06F 3/04883
USPC 345/156–183; 353/42; 382/103; 715/211, 716, 719
See application file for complete search history.

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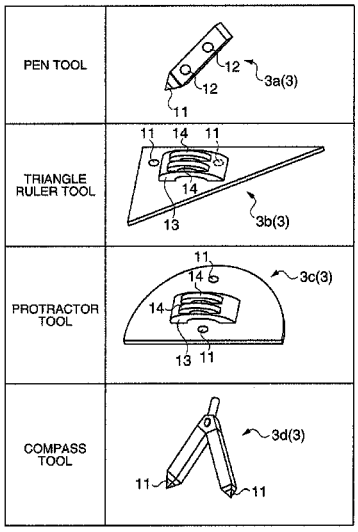
(57) **ABSTRACT**

A display device includes a display unit to display a video screen on a display surface, a information detection unit to detect position information of a plurality of detection points arranged on a stationery tool imitating a shape of a stationery, and identification information added to the plurality of detection points respectively and different among the plurality of detection points, and an angle determination unit to determine a rotation angle of the stationery tool on the display surface based on the position information of the plural detection points.

33 Claims, 6 Drawing Sheets



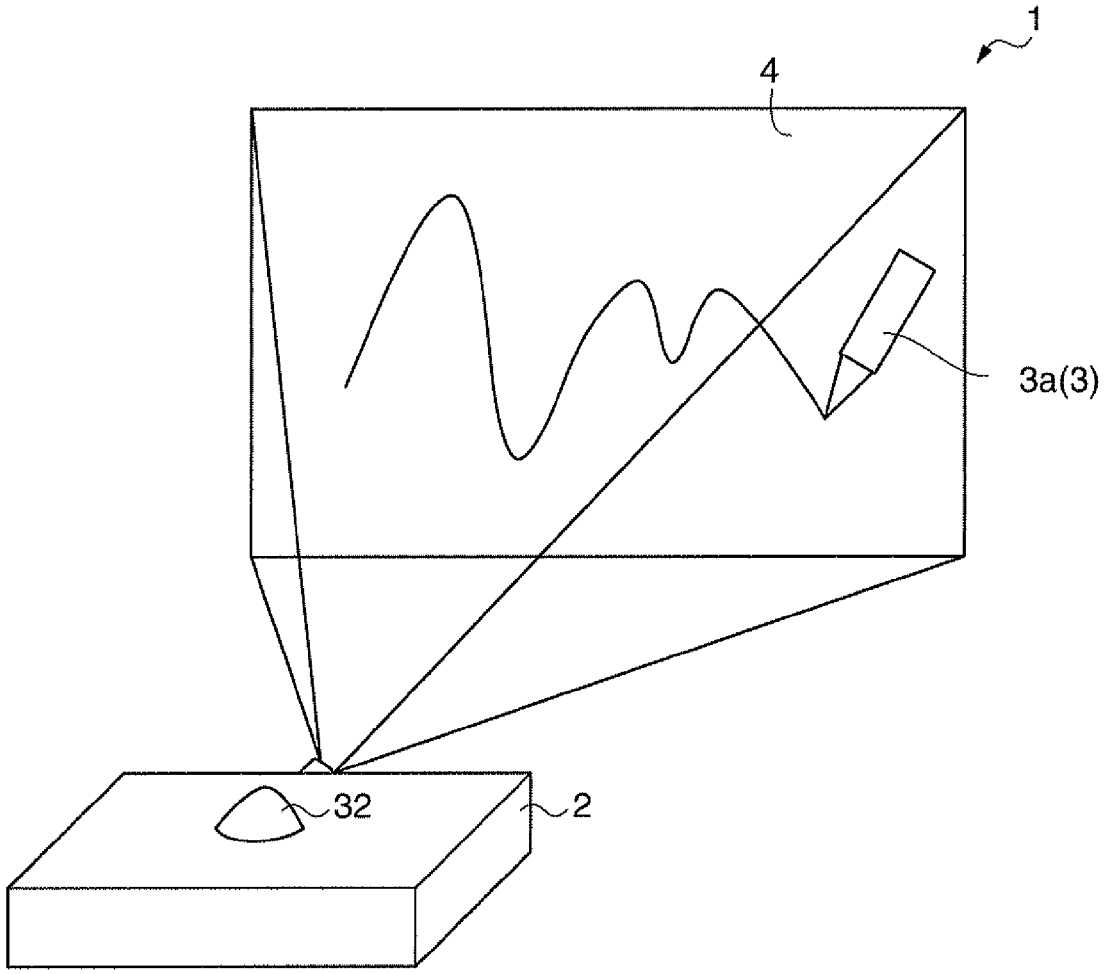


FIG. 1

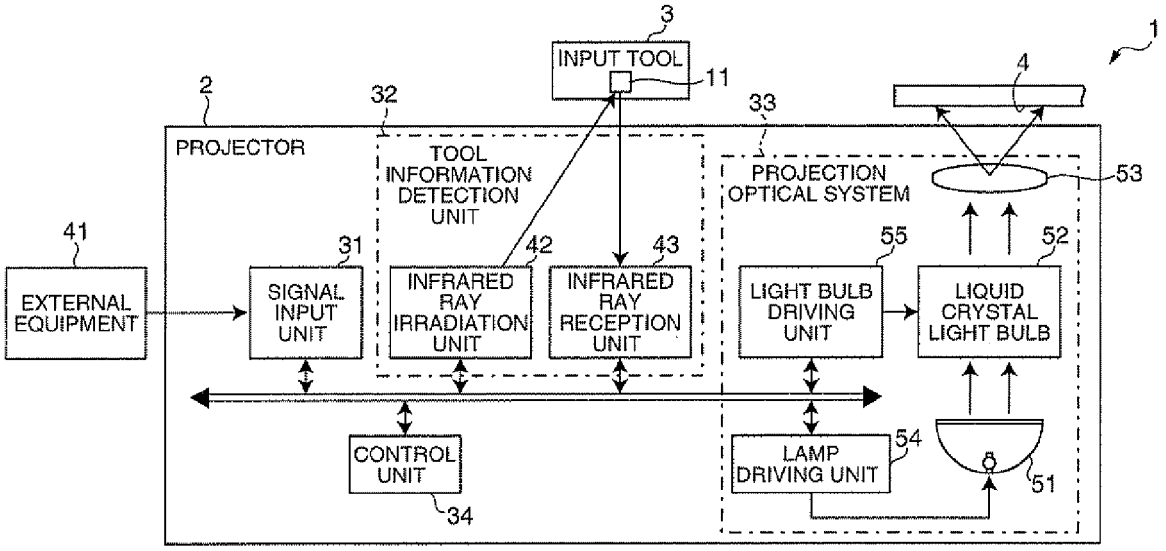

3
INPUT TOOL
11
1
4
2
32
33
PROJECTOR
TOOL INFORMATION DETECTION UNIT
PROJECTION OPTICAL SYSTEM
53
41
31
42
43
55
52
EXTERNAL EQUIPMENT
SIGNAL INPUT UNIT
INFRARED RAY IRRADIATION UNIT
INFRARED RAY RECEPTION UNIT
LIGHT BULB DRIVING UNIT
LIQUID CRYSTAL LIGHT BULB
CONTROL UNIT
34
LAMP DRIVING UNIT
54
51

FIG. 2

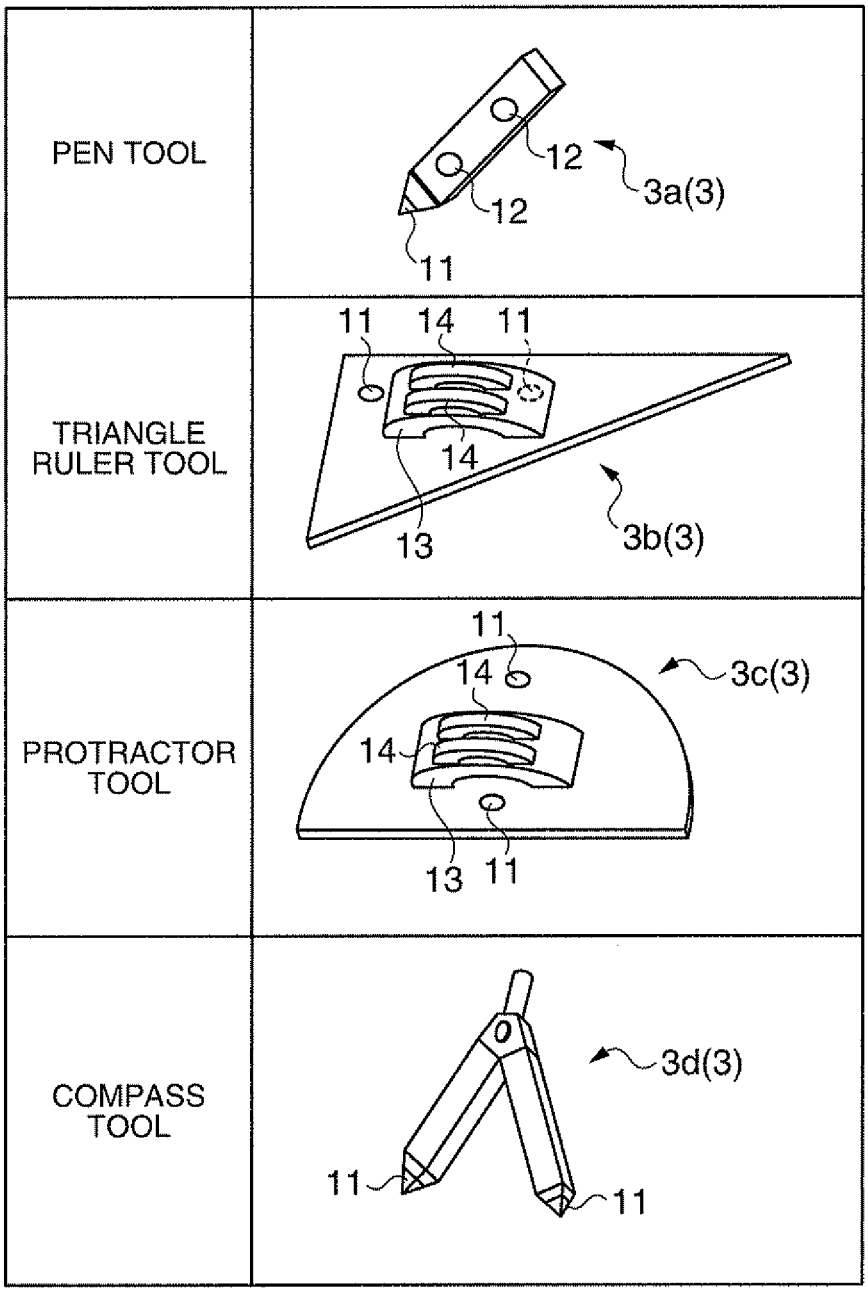

PEN TOOL
12
12
3a(3)
11
TRIANGLE RULER TOOL
11
14
11
14
13
3b(3)
PROTRACTOR TOOL
11
14
3c(3)
14
13
11
COMPASS TOOL
3d(3)
11
11

FIG. 3

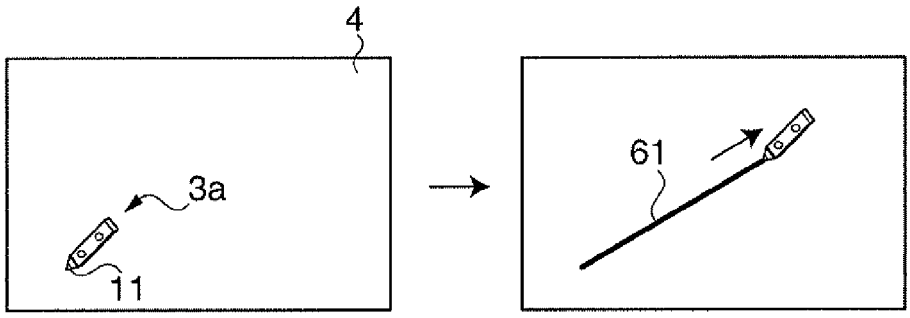


FIG. 4A

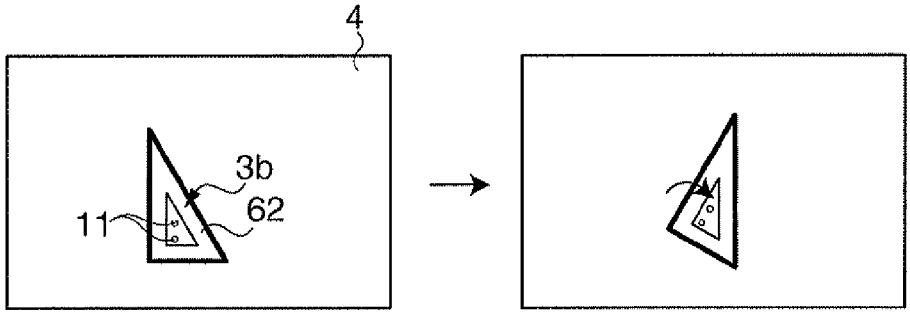


FIG. 4B

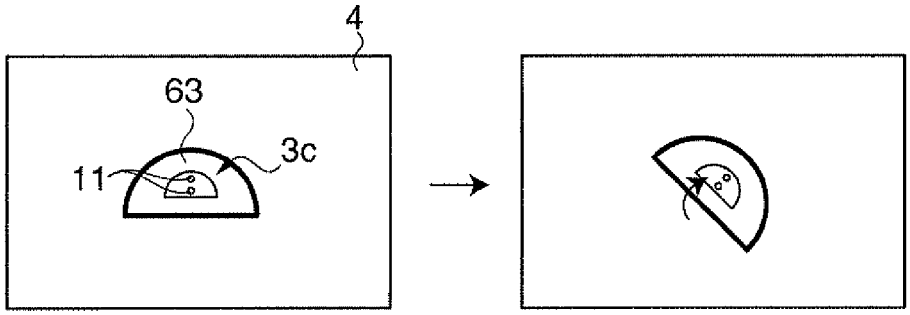


FIG. 4C

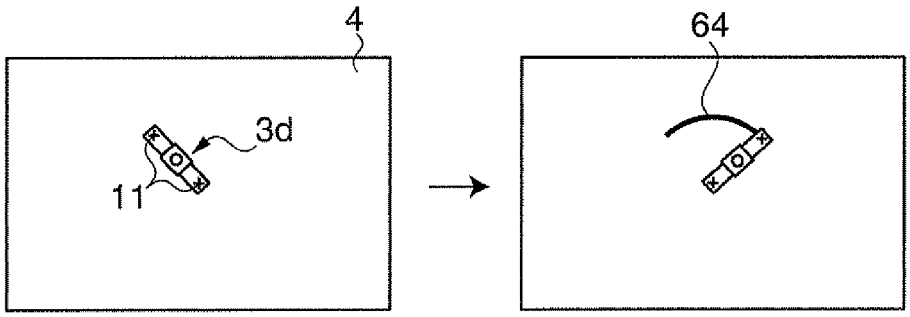


FIG. 4D

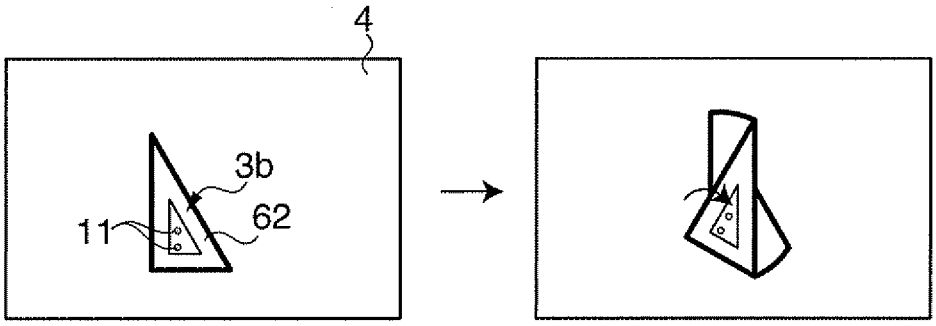


FIG. 5A

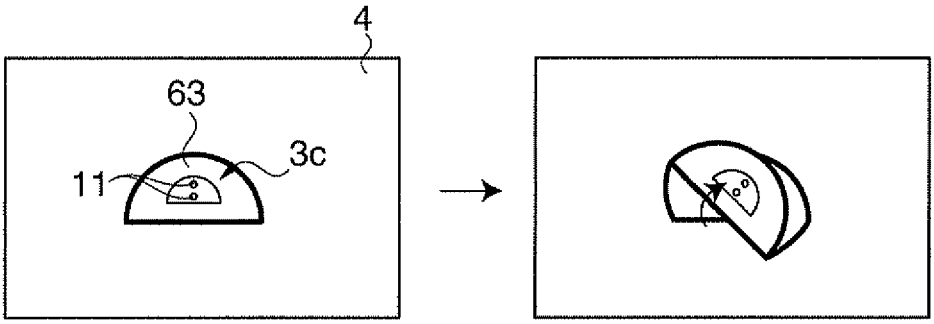


FIG. 5B

FIG. 6A

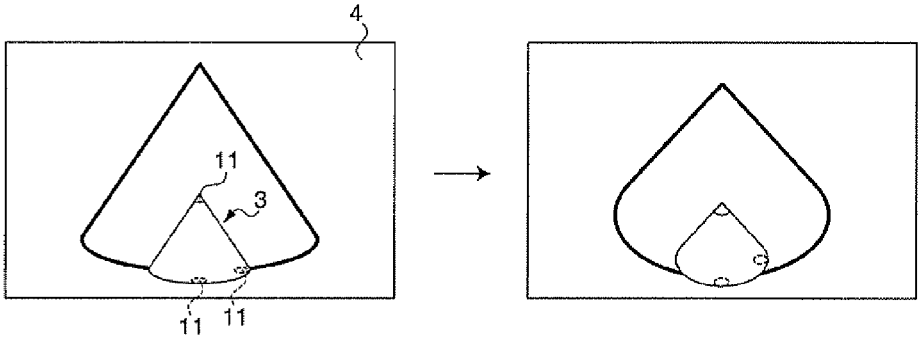
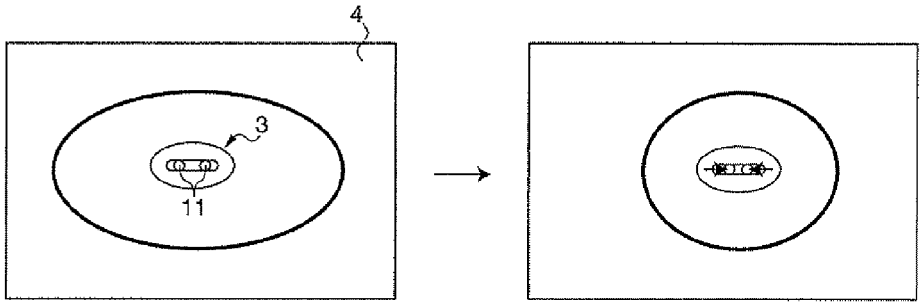


FIG. 6B



DISPLAY DEVICE, CONTROL METHOD OF DISPLAY DEVICE AND PROGRAM

The entire disclosure of Japanese Patent Application No. 2011-183205, filed Aug. 25, 2011 is expressly incorporated by reference herein.

BACKGROUND

1. Technical Field

The present invention relates to a display device which displays a video screen on a display surface and performs display control of the video screen in accordance with an operation to the display surface, a control method of the display device and a program.

2. Related Art

Hitherto, as this type of display device, there is known a display device which includes many sensors to detect a locus of a character or the like written on a writing surface of an electronic board by a pen-like writing instrument, recognition means for recognizing the character and figure drawn on the writing surface based on image data of the locus detected by the sensors, command execution means for editing the recognized character and figure in accordance with an edit command, and projection display means for displaying the edited character and figure on the writing surface (see JP-A-5-330289).

In this display device, edit commands such as erasure, movement, copy, and call are prepared, and the command execution means executes the erasure, movement or copy of the character and figure in accordance with the edit command inputted by the writing instrument.

At school or the like, as in a lesson of how to use a triangle ruler or a protractor, there is a case where a stationery is suitably rotated, and its usage is taught. In such a lesson, when the related art display device is used, since a figure can not be rotated, there is a problem that after a figure is drawn, a figure obtained by rotating the figure must be additionally drawn. Besides, although it is conceivable that a command to rotate a figure is installed as an edit command of the pen-like writing instrument, there is a problem that the number of edit commands of the pen-like writing instrument increases, and the operation becomes complicated.

SUMMARY

An advantage of some aspects of the invention is to provide a display device which can easily rotate a displayed figure by an intuitive operation, a control method of the display device and a program.

An aspect of the invention is directed to a display device including a display unit to display a video screen on a display surface, a information detection unit to detect position information of plural detection points arranged on a stationery tool imitating a shape of a stationery, and identification information added to the plurality of detection points respectively and different among the plurality of detection points, and an angle determination unit to determine a rotation angle of the stationery tool on the display surface based on the position information of the plurality of detection points.

In this case, it is preferable that a display control unit to display an object corresponding to the stationery tool is further provided, and the display control unit rotates and displays the object based on the determined rotation angle of the stationery tool.

Another aspect of the invention is directed to a control method of a display device to display a video screen on a display surface includes detecting position information of a plurality of detection points arranged on a stationery tool imitating a shape of a stationery, and identification information added to the plurality of detection points respectively and different among the plurality of detection points, determining a rotation angle of the stationery tool on the display surface based on the position information of the plurality of detection points, and displaying an object corresponding to the stationery tool on the video screen, wherein the object is rotated and displayed based on the determined rotation angle of the stationery tool.

According to this configuration, since the rotation angle of the stationery tool is determined and is reflected on the object on the video screen, the corresponding object (figure) can be easily rotated by an intuitive operation by only rotating the stationery tool. For example, an object of a triangle ruler or a protractor can be rotated by rotating a stationery tool of the triangle ruler or a stationery tool of the protractor.

It is preferable that in the display device, the stationery is one of a ruler and a protractor.

According to this configuration, the ruler or the protractor can be rotated and displayed. Incidentally, the "ruler" here is not limited to a straightedge, but may be, for example, a triangle ruler or the like.

Besides, it is preferable that a type determination unit to determine a type of the stationery tool based on a combination of the detected identification information of the plural detection points is further provided, and the display control unit displays the object corresponding to the type determined by the type determination unit.

When different identification information are assigned to all the detection points of various stationery tools, the number of identification information increases and the detection process becomes complicated.

On the other hand, according to this configuration, since the type of the stationery tool is determined based on the combination of the identification information, the number of the identification information can be decreased. Thus, the detection process of the identification information becomes easy.

Besides, it is preferable that the information detection unit detects operation information of operator disposed in the stationery tool, and the display control unit changes a size and/or a color of the object based on the detected operation information.

According to this configuration, a mode of the object can be changed by the operation on the stationery tool.

Besides, it is preferable that the display control unit displays a rotational locus of the object when the object is rotated.

According to this configuration, since the rotational locus of the object is displayed, the movement of the object can be displayed.

In this case, it is preferable that the display surface is a projection surface, and the display unit projects the video screen onto the projection surface.

According to this configuration, the object can be displayed on a screen, a wall or a whiteboard. That is, as the display device, an electronic board (interactive whiteboard) can be used.

Still another aspect of the invention is directed to a computer readable storage medium storing a program which causes a computer to execute the control method of the display device.

According to this configuration, the control method of the display device can be executed by only installing the program stored by a computer readable storage medium.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1** is a schematic view of a projector system of an embodiment.

FIG. **2** is a control block diagram of the projector system.

FIG. **3** is a view showing respective input tools.

FIGS. **4**A to **4**D are explanatory views for explaining display control based on operations of the respective input tools.

FIG. **5**A is an explanatory view for explaining a modified example of display control based on the operation of a triangle ruler tool. FIG. **5**B is an explanatory view for explaining a modified example of display control based on the operation of a protractor tool.

FIGS. **6**A and **6**B are explanatory views for explaining modified examples of input tools and display control.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Hereinafter, a display device, a control method of the display device and a program according to an embodiment of the invention will be described with reference to the accompanying drawings. In this embodiment, a projector system will be exemplified in which a projector as a display device is a component. As shown in FIG. **1** and FIG. **2**, a projector system **1** includes a projector (display device) **2** to project a video screen on a projection surface (display surface) **4**, and plural types of input tools **3** to perform an operation on the projection surface **4**. That is, the projector system **1** has a function as an electronic board (interactive whiteboard).

As shown in FIG. **3**, the input tool **3** is a tool which is made to face the projection surface **4**, and performs a drawing operation of drawing on the video screen and a display operation of displaying a specific object on the video screen. The plural types of input tools **3** include a pen tool **3***a* (electronic pen), a triangle ruler tool (stationery tool) **3***b*, a protractor tool (stationery tool) **3***c* and a compass tool **3***d*. Incidentally, plural input tools **3** may be provided for each of the types. Besides, at least one modulation reflection unit **11** is disposed in each of the input tools **3**, and the disposition position of the modulation reflection unit **11** is a detection point for detecting the position information of the input tool **3**. The modulation reflection unit **11** modulates an infrared ray irradiated from the projector **2** into a specific pattern and reflects the infrared ray to the projector **2**. On the other hand, although the details will be described later, the projector **2** receives the modulated and reflected infrared ray, and detects the position information of the detection point of the input tool **3**. Incidentally, the modulation reflection unit **11** modulates the infrared ray into the specific pattern which includes an identification signal to identify the input tool **3** and the detection point, and an operation signal indicating the operation content of operators (an attribute change button **12** and an attribute change dial **14** described later) on the input tool **3**, so that the projector **2** can detect the identification information and the operation information.

The pen tool **3***a* imitates the shape of a pen, and includes the modulation reflection unit **11** disposed at a tip section and the attribute change button **12** disposed on a side surface. That is, the detection point of the pen tool **3***a* is arranged at the tip section thereof. A drawing operation to the projection screen is performed by an operation of moving the tip section of the pen tool **3***a* on the projection surface **4**. Besides, the color and thickness of a drawn line (line object **61**) can be changed by depressing the attribute change button **12**.

The triangle ruler tool **3***b* imitates the shape of a triangle ruler (stationery: ruler), and includes two modulation reflection units **11** disposed at separate positions, a grip **13** disposed on the surface of a main body, and two attribute change dials (operators) **14** disposed on the grip **13**. That is, the detection points of the triangle ruler tool **3***b* are arranged at the two separate places of the main body. The main body of the triangle ruler tool **3***b* is made to face the projection surface **4**, and a display operation to display a triangle ruler object (after-mentioned triangle ruler object **62**) on the video screen is performed. Besides, the color and size of the triangle ruler object to be displayed can be changed by operating the respective attribute change dials **14**.

The protractor tool **3***c* imitates the shape of a protractor (stationery), and includes the two modulation reflection units **11** disposed at separate positions, the grip **13** disposed on the surface of a main body, and the two attribute change dials (operators) **14** disposed on the grip **13**. That is, the detection points of the protractor tool **3***c* are arranged at the two separate places of the main body. The main body of the protractor tool **3***c* is made to face the projection surface **4**, and a display operation to display a protractor object (after-mentioned protractor object **63**) on the video screen is performed. Besides, the color and size of the protractor object to be displayed can be changed by operating the respective attribute change dials **14**. Incidentally, it is preferable that the attribute change dial **14** to change the color in the triangle ruler tool **3***b* and the protractor tool **3***c* has a click feeling at the change of attribute.

The compass tool **3***d* imitates the shape of a compass, and includes the two modulation reflection units **11** disposed at tip sections of two legs. That is, the detection points of the compass tool **3***d* are disposed at the tip sections of the two legs. The tip section of one of the legs is placed on the projection surface **4**, this is not moved but is rotated, and the other leg is moved on a rotational locus, so that a drawing operation of an arc or a circle on the video screen is performed. Incidentally, similarly to a compass, the opening angle of the two legs of the compass tool **3***d* can be freely changed, and a circle having an arbitrary size can be drawn.

As shown in FIG. **2**, the projector **2** includes a signal input unit **31**, a tool information detection unit (information detection unit) **32**, a projection optical system (display unit) **33**, and a control unit **34** to overall control these. An angle determination unit and a display control unit in the appended claims are constructed of the control unit **34**.

The signal input unit **31** inputs image data from an external equipment **41** such as a PC (Person Computer), a USB memory or a compact flash (registered trademark). In this case, the signal input unit **31** includes a not-shown USB port or a memory card slot. Incidentally, in this embodiment, although image data is inputted from the external equipment **41** through the signal input unit **31**, an image signal may be inputted from a video equipment such as a video recorder or a DVD player. In this case, the signal input unit **31** includes an HDMI terminal, an S-video terminal, a video terminal and the like.

The tool information detection unit **32** detects position information and identification information of the respective detection points of the respective input tools **3** based on the infrared ray modulated and reflected by the modulation reflection unit **11**, and detects the operation information of the respective input tools **3**. Specifically, the tool information detection unit **32** includes an infrared ray irradiation unit **42** to irradiate an infrared ray to the projection surface **4**, and an infrared ray reception unit **43** to receive the infrared ray

modulated and reflected by the modulation reflection unit **11** of the input tool **3**, and detects the position information of the respective detection points based on the infrared rays reflected from the respective detection points. Besides, the infrared ray modulated into a specific pattern including an identification signal and an operation signal is received, so that the identification information of the input tool **3** and the respective detection points based on the identification signal, and the operation information of the input tool **3** based on the operation signal are detected. The position information is coordinate information of the position of the detection point relative to the projection surface **4**. The identification information is information for identifying the respective input tools **3** and the respective detection points. Thus, the identification information different among the respective detection points is added to the respective detection points. The operation information is information indicating the operation content of an operation to the operator (the attribute change button **12**, the attribute change dial **14**) on the input tool **3**. Since the tool information detection unit **32** detects the identification information of the respective detection points together with the position information of the respective detection points, the control unit **34** can identify that the detected position information is information of which detection point.

The projection optical system **33** projects an image on the projection surface **4**, and includes a light source lamp **51**, a liquid crystal light bulb **52**, a projection lens **53**, a lamp driving unit **54** and a light bulb driving unit **55**.

A halogen lamp, a metal halide lamp or a high pressure mercury lamp can be applied as the light source lamp **51**. A solid lamp such as a laser or an LED may be used instead of the light source lamp **51**. The liquid crystal light bulb **52** includes a liquid crystal panel and the like in which a liquid crystal is sealed between a pair of transparent substrates, and transparent electrodes capable of applying drive voltages to respective minute areas of the liquid crystal are formed in a matrix form as pixels on the inner surfaces of the respective transparent substrates. The lamp driving unit **54** turns on the light source lamp **51** based on a lighting instruction from the control unit **34**. The light bulb driving unit **55** sets the light transmittance of the respective pixels by applying drive voltages corresponding to image data to the respective pixels of the liquid crystal light bulb **52**.

With the above configuration, in the projection optical system **33**, the illumination light emitted from the light source lamp **51** passes through the liquid crystal light bulb **52** and is modulated. The modulated image light is synthesized for the respective pixels by a not-shown light synthesizing optical system (dichroic prism etc.), and is projected onto the projection surface **4** by the projection lens **53**.

The control unit **34** includes a CPU (Central Processing Unit), a ROM (Read Only Memory), a RAM (Random Access Memory) and the like. The CPU is a central processing unit to perform various arithmetic processes, and overall controls the projector **2** by performing input and output of signals with the each unit. The ROM stores control programs and control data used by the CPU to perform various arithmetic processes. Besides, the ROM stores also an OS (Operating System) as basic software. The RAM is used as a work area when the CPU performs various arithmetic processes. Incidentally, in this embodiment, display control based on the operation of the input tool **3** is especially performed.

Here, the display control based on the operation of the respective input tools **3** will be described in order of the pen tool **3***a*, the triangle ruler tool **3***b*, the protractor tool **3***c* and the compass tool **3***d* with reference to FIGS. **4**A to **4**D. Incidentally, identification information different among the respective input tools **3** is assigned to the respective input tools **3**, and the control unit **34** determines the type (the pen tool **3***a*, the triangle ruler tool **3***b*, etc.) of the input tool **3** based on the identification information detected by the tool information detection unit **32**.

In the display control to the pen tool **3***a*, the projector **2** receives the infrared ray from the modulation reflection unit **11** of the pen tool **3***a* by the tool information detection unit **32** at all times, and detects the position information and the identification information of the detection point, and the operation information. The control unit **34** determines the movement locus of the detection point on the projection surface **4** based on the detected position information of the detection point. When the movement locus is determined, the line object **61** is displayed on the video screen correspondingly to the determined movement locus (see FIG. **4**A). At this time, the color and thickness of the line object **61** are changed based on the operation information. That is, the control unit **34** changes the color and thickness of the line object **61** according to the depression of the attribute change button **12**.

In the display control to the triangle ruler tool **3***b*, the projector **2** receives the infrared rays from the two modulation reflection units **11** of the triangle ruler tool **3***b* by the tool information detection units **32** at all times, and detects the position information and the identification information of the respective detection points, and the operation information (information detection step). At each time of detection, the control unit **34** determines the position of the triangle ruler tool **3***b* on the projection surface **4** and the rotation angle from the initial posture based on the detected position information (angle determination step). When the position and the rotation angle are determined, the object (hereinafter, the triangle ruler object **62**) indicating the triangle ruler is displayed at the position on the video screen corresponding to the determined position, and is rotated and displayed on the video screen correspondingly to the determined rotation angle (display control step: see FIG. **4**B). At this time, the color and size of the triangle ruler object **62** are changed based on the operation information. That is, the control unit **34** changes the color and size of the triangle ruler object **62** according to the operation of the attribute change dial **14**.

In the display control to the protractor tool **3***c*, the projector **2** receives the infrared rays from the two modulation reflection units **11** of the protractor tool **3***c* by the tool information detection unit **32** at all times, and detects the position information and the identification information of the respective detection points, and the operation information (information detection step). At each time of detection, the control unit **34** determines the position of the protractor tool **3***c* on the projection surface **4** and the rotation angle from the initial posture based on the detected position information (angle determination step). When the position and the rotation angle are determined, the object (hereinafter, the protractor object **63**) indicating the protractor is displayed at the position on the video screen corresponding to the determined position, and is rotated and displayed on the video screen correspondingly to the determined rotation angle (display control step: see FIG. **4**C). At this time, the color and size of the protractor object **63** are changed based on the operation information. That is, the control unit **34** changes the color and size of the protractor object **63** according to the operation of the attribute change dial **14**.

In the display control to the compass tool **3***d*, the projector **2** receives the infrared rays from the two modulation reflection units **11** of the compass tool **3***d* by the tool information detection unit **32** at all times, and detects the position infor-

mation and the identification information of the respective detection points, and the operation information. The control unit **34** determines the drawing operation of the compass tool **3***d* to draw an arc or a circle based on the detected position information. The drawing operation is an operation in which the detection point at the fulcrum point side is not moved, and the other detection point is moved along the rotational orbit with the center at the detection point on the fulcrum point side. The presence or absence of the drawing operation is determined based on the position change of the respective detection points, and the fulcrum point position of the drawing operation, the drawing start position of the drawing operation and the drawing end position are determined based on the position information of the respective detection points before and after the operation. When these are determined, a line object **64** of a circle or an arc is displayed on the video screen correspondingly to the determined drawing operation (see FIG. **4**D).

According to the configuration as stated above, since the rotation angle of the stationery tool (the triangle ruler tool **3***b*, the protractor tool **3***c*) is reflected on the object (the triangle ruler object **62**, the protractor object **63**) on the video screen, by merely rotating the stationery tool, the corresponding object (figure) can be easily rotated by the intuitive operation.

Besides, the size and/or the color of the object is changed according to the operation of the attribute change dial **14** disposed on the stationery tool, and the mode (appearance) of the object can be changed by the operation on the stationery tool.

In this embodiment, the identification information different among the respective input tools **3** is assigned to the respective input tools **3**, and the type of the input tool **3** is determined based on this. However, this configuration may be modified such that the control unit **34** determines the type of the input tool **3** based on a combination of detected identification information of plural detection points (type determination unit), and displays an object corresponding to the determined type. That is, for example, identification number **1** and identification number **2** are assigned to the two detection points of the triangle ruler tool **3***b*, and identification number **1** and identification number **3** are assigned to the two detection points of the protractor tool **3***c*. When the combination of the identification number **1** and the identification number **2** is detected, the input tool is determined to be the triangle ruler tool **3***b*, and when the combination of the identification number **1** and the identification number **3** is detected, the input tool is determined to be the protractor tool **3***c*. According to the configuration as stated above, as compared with the case where different identification information is assigned to all the detection points of the plural input tools **3**, the number of identification information can be decreased. Thus, the detection process of the identification information by the tool information detection unit **32** becomes easy. Incidentally, the distance between the two detection points is preferably made a constant distance irrespective of the input tool **3**. According to this configuration, even when the plural input tools **3** are simultaneously used, the rotation angles of the respective input tools **3** can be accurately detected based on the distance between the detection points.

Besides, as shown in FIGS. **5**A and **5**B, in this embodiment, when the triangle ruler object **62** or the protractor object **63** is rotated on the video screen, the rotational locus of the object may be displayed. According to this configuration, the movement of the object can be displayed by displaying the rotational locus of the object. Besides, the rotational locus can be preferably erased by the operation of the attribute change dial **14** at a timing desired by a user.

Further, in the embodiment, the rotation angle of the triangle ruler tool **3***b* or the protractor tool **3***c* on the projection surface **4** is determined. However, this configuration may be modified such that a rotation angle in a three-dimensional coordinate is determined, and this is reflected on a three-dimensional object on the video screen. For example, the input tool **3** having a three-dimensional shape (in the drawing, the input tool **3** having a triangular pyramid shape) as shown in FIG. **6**A is prepared, and the position information of three or more detection points arranged thereon in the three-dimensional coordinate are detected. Thereafter, the rotation angles of the input tool **3** in the three-dimensional coordinate are determined based on the position information of the respective detection points in the three-dimensional coordinate. Then, the control unit **34** rotates and displays a three-dimensional object corresponding to the input tool **3** correspondingly to the determined rotation angles in the three-dimensional coordinate. Incidentally, in order to identify the rotation angles in the three-dimensional coordinate, identification information different among the respective detection points is added also to the three or more detection points.

Further, in the embodiment, the detection points are fixedly arranged for the respective input tools **3**. However, this configuration may be modified such that the detection point (the modulation reflection unit **11**) is freely moved in the input tool **3**, and the object on the video screen is modified and displayed correspondingly to the movement. For example, an elliptical input tool **3** as shown in FIG. **6**B is prepared. The elliptical input tool **3** includes the two modulation reflection units **11** disposed to be symmetrically movable on the long axis. The two modulation reflection units **11**, that is, the two detection points correspond to focal points of an elliptical object to be displayed, and the control unit **34** displays, on the video screen, an elliptical object in which the positions of the focal points are changed according to the symmetrical movement of the two modulation reflection units **11**.

Incidentally, in the embodiment, the infrared ray is modulated and reflected at the respective detection points, and this is received so that the position information and the identification information of the respective detection points are detected. However, this configuration may be modified such that marks which can be identified by image recognition are arranged at the respective detection points, and the marks are image-recognized, so that the position information and the identification information of the detection points on the projection surface **4** are detected. Besides, when the board surface of the whiteboard is made the projection surface **4**, the whole board surface is made to function as a sensor, and the position information and the identification information of the respective detection points may be detected.

Besides, in the embodiment, although the invention is applied to the projector **2** to project the video screen onto the projection surface **4**, the invention may be applied to a display device (monitor) to display the video screen. In this case, the display surface in the appended claims is not the display device itself, but is a portion of the surface of the display device on which the video screen is displayed.

What is claimed is:

1. A display device comprising:

a display unit to display a video screen on a display surface;

an information detection unit to detect position information on the display surface of a plurality of detection points arranged on a tool having a shape of a stationery tool, the detection points being in contact with the display surface when being detected, and the tool having identification information added to the plurality of

detection points, respectively, and the identification information being different among the plurality of detection points; and

an angle determination unit to determine a rotation angle of the tool on the display surface based on the position information of the plurality of detection points.

2. The display device according to claim **1**, further comprising:

a display control unit to display an object corresponding to the stationery tool, wherein

the display control unit rotates and displays the object based on the determined rotation angle of the tool.

3. The display device according to claim **2**, wherein the tool is one of a ruler and a protractor.

4. The display device according to claim **2**, further comprising:

a type determination unit to determine a type of the tool based on a combination of the detected identification information of the plurality of detection points, wherein

the display control unit displays the object corresponding to the type of the tool determined by the type determination unit.

5. The display device according to claim **2**, wherein

the information detection unit detects operation information of an operator of the tool, and

the display control unit changes a size and/or a color of the object based on the detected operation information.

6. The display device according to claim **2**, wherein

the display control unit displays a rotational locus of the object when the object is rotated.

7. The display device according to claim **6**, wherein

the information detection unit detects operation information of an operator of the tool, and

the display control unit erases the rotational locus based on the detected operation information.

8. The display device according to claim **1**, wherein

the display surface is a projection surface, and

the display unit projects the video screen onto the projection surface.

9. The display device according to claim **1**, wherein the position information indicates a position of the tool relative to the display surface.

10. A control method of a display device to display a video screen on a display surface, comprising:

detecting position information on the display surface of a plurality of detection points arranged on a tool having a shape of a stationery tool, the detection points being in contact with the display surface when being detected, and the tool having identification information added to the plurality of detection points, respectively, and the identification information being different among the plurality of detection points;

determining a rotation angle of the tool on the display surface based on the position information of the plurality of detection points; and

displaying an object corresponding to the tool on the video screen, wherein

the object displayed on the video screen is rotated based on the determined rotation angle of the tool.

11. A non-transitory computer readable storage medium storing a program to cause a computer to execute the control method of the display device according to claim **10**.

12. A tool for use with a display device having a display surface, the tool comprising:

a tool body configured to be placed on the display surface; and

a plurality of separate detection points provided on the tool body,

when the tool body is placed on the display surface, the tool is configured to provide positions of the detection points on the display surface to the display device, the detection points being in contact with the display surface when being detected, and, based on the positions of the detection points, the display device displays a display object with a shape corresponding to a shape of the tool, and

when the tool is rotated relative to the display surface, the tool provides the rotated positions of the detection points to the display device causing the display object to be rotated to a position on the display device corresponding to the rotated position of the detection points.

13. The tool according to claim **12**, wherein the tool is configured to provide identification information for identifying the tool to the display device.

14. The tool according to claim **13**, wherein the identification information further identifies each of the detection points.

15. The tool according to claim **12**, wherein the display object has a position on the display corresponding to a position of the tool on the display surface.

16. The tool according to claim **12**, wherein the tool includes two of the detection points.

17. The tool according to claim **12**, wherein the display object has a size dimension bigger than a size dimension of the tool.

18. The tool according to claim **12**, wherein the tool is a ruler tool.

19. A system comprising:

a display device having a display surface;

a tool configured to be placed on the display surface, the tool having a plurality of separate detection points;

a detection unit configured to detect positions of the plurality of separate detection points when the detection points are in contact with the display device; and

a display control unit configured to, based on the detected positions of the detection points, display a display object on the display device in a shape corresponding to a shape of the tool, and when the tool is rotated relative to the display surface, the display control unit rotating the display object to a position on the display device corresponding to the rotated position of the detection points.

20. The system according to claim **19**, wherein the tool is configured to provide identification information for identifying the tool to the display control unit.

21. The system according to claim **20**, wherein the identification information further identifies each of the detection points.

22. The system according to claim **19**, wherein the display object has a position on the display corresponding to a position of the tool on the display surface.

23. The system according to claim **19**, wherein the tool includes two of the detection points.

24. The system according to claim **19**, wherein the display object has a size dimension bigger than a size dimension of the tool.

25. The system according to claim **19**, wherein the tool is a ruler tool.

26. The system according to claim **19**, further comprising a pen tool having a tip configured to be placed on the display surface, the pen tool configured to convey a signal to the detection unit, the detection unit configured to determine a position of the pen tip based on the signal, and

the display control unit configured to display an image on the display based on the determined position of the pen tip.

27. A method of utilizing a tool with a display device having a display surface, the tool having a plurality of separate detection points, the method comprising:

when the tool is placed on the display surface, detecting positions of the plurality of separate detection points on the display surface, the detection points being in contact with the display surface when being detected;

then displaying a display object on the display device in a shape corresponding to a shape of the tool; and

then the tool is rotated relative to the display surface, causing the display object to be rotated to a position on the display device corresponding to the rotated position of the detection points.

28. The method according to claim **27**, further comprising providing identification information for identifying the tool to a display control unit of the display device.

29. The method according to claim **28**, wherein the identification information further identifies each of the detection points.

30. The method according to claim **27**, further comprising displaying the display object at a position on the display corresponding to a position of the tool on the display surface.

31. The method according to claim **27**, wherein the tool includes two of the detection points.

32. The method according to claim **27**, further comprising displaying the display object with a size dimension that is bigger than a size dimension of the tool.

33. The method according to claim **27**, wherein the tool is a ruler tool.

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